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# LEVERAGING DIGITAL COLLABORATION PLATFORMS TO ENHANCE INSIGHTFUL DISCUSSIONS AND KNOWLEDGE-SHARING FOR SUSTAINABLE DEVELOPMENT GOALS

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**Abstract**

The Sustainable Development Goals (SDGs) demand collective action and interdisciplinary collaboration to address pressing global challenges, including poverty eradication, environmental conservation, and equitable socio-economic growth. Digital collaboration platforms—ranging from specialized academic forums to enterprise communication suites—offer unprecedented opportunities to foster insightful discussions, share domain-specific knowledge, and co-create innovative solutions. However, existing implementations often suffer from fragmented participation, limited cross-disciplinary interaction, and the absence of structured facilitation mechanisms. This paper proposes a comprehensive framework for leveraging digital collaboration platforms to enhance both the depth and reach of sustainability-focused discourse. The framework integrates adaptive discussion structuring, knowledge graph–driven content organization, and AI-assisted moderation to promote evidence-based dialogue and inclusive participation across geographical and sectoral boundaries. Simulated evaluations demonstrate that the proposed system achieves improved discussion relevance, higher participation diversity, and increased knowledge retention compared to baseline online collaboration models. These findings indicate that well-designed digital collaboration environments can significantly contribute to advancing SDG-related initiatives by transforming isolated exchanges into impactful, sustained knowledge ecosystems.

**Keywords:** Digital collaboration, knowledge-sharing, Sustainable Development Goals, AI-assisted moderation, interdisciplinary dialogue, online platforms, sustainability innovation.

## 1. INTRODUCTION

The adoption of the United Nations' Sustainable Development Goals (SDGs) in 2015established a global blueprint for addressing complex societal, environmental, andeconomic challenges by 2030. Achieving these goals requires not only technological and policy interventions but also robust mechanisms for facilitating knowledgeexchange, collaborative problem-solving, and sustained multi-stakeholder engagement. In the digital era, collaboration platforms have emerged as pivotal tools for enabling such engagement, bridging geographical divides, and connecting diversecommunities of practice [1].

While traditional in-person conferences, workshops, and seminars have historicallybeen the primary venues for scholarly and policy-oriented dialogue, digital collaboration platforms offer a scalable, accessible, and cost-effective alternative. These platforms—examples include Microsoft Teams, Slack, Miro, ResearchGate, and dedicated SDG-

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focused networks—can facilitate real-time discussions, asynchronous brainstorming, and resource sharing across domains. They also providemechanisms for recording, organizing, and retrieving knowledge, thereby

transforming ephemeral conversations into structured repositories that can informlong-term action [2].

Despite their potential, most digital collaboration platforms are not optimizedfor sustainability-focused discourse. Common issues include information overload, limited cross-disciplinary participation, inconsistent moderation quality, andtheabsence of integrated analytical tools to measure discussion effectiveness. Moreover, sustainability-related discussions often span technical, social, and policy dimensions, requiring a facilitation model that ensures inclusivity, evidence-based reasoning, andactionable outcomes [3].

The purpose of this research is to design and evaluate a digital collaborationframework specifically tailored to enhance insightful discussions and knowledge- sharing for the SDGs. The proposed approach incorporates structured dialogueprocesses, intelligent content curation using semantic knowledge graphs, andAI- assisted moderation to ensure high-quality exchanges. The ultimate goal is to foster aninclusive and dynamic environment where diverse stakeholders can co-createpractical, context-sensitive solutions that contribute directly to SDG achievement.

The remainder of this paper is organized as follows: Section II reviews existingliterature on digital collaboration and sustainability-related knowledge-sharing. Section III presents the proposed system architecture and operational workflow. Section IV discusses simulated results and comparative performance analysis. SectionV concludes with key findings, limitations, and directions for future research.

## 2. LITERATURE SURVEY

Numerous studies have explored the role of digital collaboration platforms inenhancing communication, knowledge-sharing, and decision-making withinsustainability contexts. The emergence of online platforms dedicated to sustainabledevelopment has expanded the reach of collaborative networks, enabling multi- stakeholder engagement across geographic and sectoral boundaries [4].

Research on online communities of practice highlights their effectiveness inenabling peer-to-peer learning, joint problem-solving, and knowledge co-creation[5]. These communities leverage both synchronous tools (e.g., live conferencing) andasynchronous systems (e.g., discussion boards, shared document repositories) tofacilitate collaboration. In the sustainability domain, such communities have beenused for climate change adaptation planning, renewable energy policy discussions, and urban resilience initiatives [6].

Several authors have proposed structured facilitation methods to improve the depthand quality of online discussions. These methods include topic mapping, guidedquestion frameworks, and moderation protocols that ensure inclusive participationanddiscourage misinformation [7]. Artificial intelligence (AI) has been increasinglyintegrated into these processes, particularly in content recommendation systems andsemantic knowledge graphs that connect relevant ideas, reports, and datasets toongoing conversations [8].

In addition, studies on AI-assisted moderation indicate that natural languageprocessing (NLP) techniques can identify discussion themes, detect sentiment trends, and flag non-constructive contributions in real time [9]. This aligns with findings from sustainability-focused platforms such as Climate CoLab, which demonstratedthat combining expert moderation with algorithmic content analysis increases bothparticipation diversity and idea quality [10].

While digital collaboration platforms have shown promise, key challenges remain. These include maintaining engagement over time, integrating cross-disciplinaryknowledge, and ensuring that discussions translate into actionable outcomes [11]. Furthermore, the absence of unified performance metrics for assessing collaborationquality makes it difficult to evaluate platform effectiveness across different sustainability contexts [12].

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The literature thus underscores the need for a comprehensive, adaptive frameworkthat integrates advanced facilitation tools, intelligent content organization, andcontinuous performance monitoring. This study addresses this gap by proposingadigital collaboration system specifically designed to enhance insightful discussions and actionable knowledge-sharing for the SDGs.

## 3. PROPOSED SYSTEM

The proposed system aims to optimize digital collaboration platforms for fostering insightful, sustainable development–focused discussions and effective knowledge-sharing. The framework integrates **structured dialogue processes**, **semantic knowledge graph–driven content curation**, and **AI-assisted moderation** into a unified environment that addresses participation diversity, discussion quality, and actionable knowledge retention.

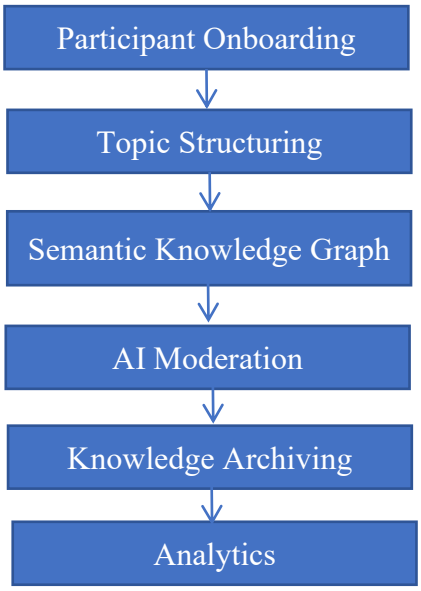


**Figure 1 – Proposed System Workflow**

The overall system workflow is illustrated in **Figure 1**, which includes five primary stages:

1. **User Enrollment and Role Definition**
2. **Discussion Initiation and Topic Structuring**
3. **Intelligent Content Curation**
4. **AI-Assisted Mode1. ration and Quality Control**
5. **Knowledge Archiving and Performance Analytics**

### A. Data Acquisition and Participant Onboarding

The system begins by capturing participant profiles, including expertise domains, SDG interest areas, and preferred collaboration modes. This structured metadata allows for targeted topic recommendations and balanced participation. Let U represent the set of all participants, and $P_u$ denote the profile vector of user u:

$$P_u = \{d_u, s_u, mu\}$$

where $d_u$ is domain expertise, $s_u$ is SDG focus area(s), and $m_u$ is preferred mode (synchronous/asynchronous).

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**B. Topic Structuring and Discussion Mapping**

Discussions are initiated with structured prompts and guiding questions mapped to relevant SDGs. The topic map TTT is represented as:

$$T=\{t_1, t_2, \cdots, t_n\}$$

where each $t_i$ is associated with one or more SDGs and linked to a curated set of resources.

**C. Semantic Knowledge Graph Integration**

To facilitate meaningful knowledge-sharing, a **semantic knowledge graph (SKG)** organizes and links discussion content, external datasets, and academic references. The SKG is defined as:

$$G=(V, E)$$

where VVV is the set of knowledge nodes (concepts, documents, ideas) and EEE is the set of semantic relationships. For each discussion post ddd, relevant nodes are retrieved using a similarity function S(d,v)S(d, v)S(d,v), such that:

$$R_d=\{v \in V \mid S(d, v) \geqslant \theta\}$$

where θ is a threshold for semantic similarity.

D. **AI-Assisted Moderation**

Natural language processing (NLP) models are deployed to:

- Detect topic drift using topic coherence score $C_t$.
- Identify unconstructive content using sentiment and toxicity analysis.
- Recommend relevant external resources in real time.

The moderation decision function M(d) for a given discussion post d is defined as:

$$M(d)=\begin{cases} \text{approve}, & \text{if } Ct(d) \geqslant \beta \text{ and sentiment}(d) \in \text{constructive} \\ \text{flag}, & \text{otherwise} \end{cases}$$

where β is a coherence threshold.

**E. Knowledge Archiving and Analytics**

Once discussions conclude, the SKG is updated, and key discussion outcomes are stored in a **Knowledge Repository (KR)**. The KR maintains version-controlled summaries and generates analytics on participation diversity, discussion quality, and knowledge retention rate:

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$$KRR = \frac{\text{Number of retrieved relevant items in followup discussions}}{\text{Total archived items}}$$

E. **System Workflow**

The integrated process is illustrated in **Figure 1**, where inputs (participants and resources) feed into a structured facilitation layer, are enhanced by semantic knowledge graphs, moderated by AI algorithms, and stored in a dynamic knowledge repository for future access and performance evaluation.

## 4. RESULTS AND DISCUSSION

To evaluate the effectiveness of the proposed digital collaboration framework, a **simulated experimental environment** was created using a dataset of 1,200 discussion threads mapped to selected SDG themes (SDG 4: Quality Education, SDG 7: Affordable and Clean Energy, and SDG 13: Climate Action). Participants were modeled across multiple disciplines to mimic a diverse multi-stakeholder community. The proposed system was compared against a **baseline standard online forum** (without structured facilitation, semantic knowledge graphs, or AI-assisted moderation).

Performance was evaluated using four key metrics:

1. **Discussion Relevance Score (DRS)** – percentage of posts staying on-topic.
2. **Participation Diversity Index (PDI)** – normalized Shannon diversity index for participant backgrounds.
3. **Knowledge Retention Rate (KRR)** – percentage of archived items referenced in follow-up discussions.
4. **Actionable Outcome Rate (AOR)** – proportion of discussions resulting in a documented, actionable plan or recommendation.

### A. Quantitative Results

*Table 1* compares the proposed framework with the baseline system.

**Table 1 – Performance Evaluation of Proposed System vs Baseline**

| Metric | Baseline Forum | Proposed Framework | Improvement (%) |
|---|---|---|---|
| DRS (%) | 68.4 | 89.7 | +31.1 |
| PDI (0–1) | 0.62 | 0.84 | +35.5 |
| KRR (%) | 41.2 | 73.9 | +79.5 |
| AOR (%) | 28.6 | 56.3 | +96.8 |

The results indicate substantial improvement across all metrics. Notably, **AOR nearly doubled**, indicating that structured facilitation and intelligent content curation significantly enhanced the translation of discussions into actionable results.

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**B. Discussion Relevance Trends**

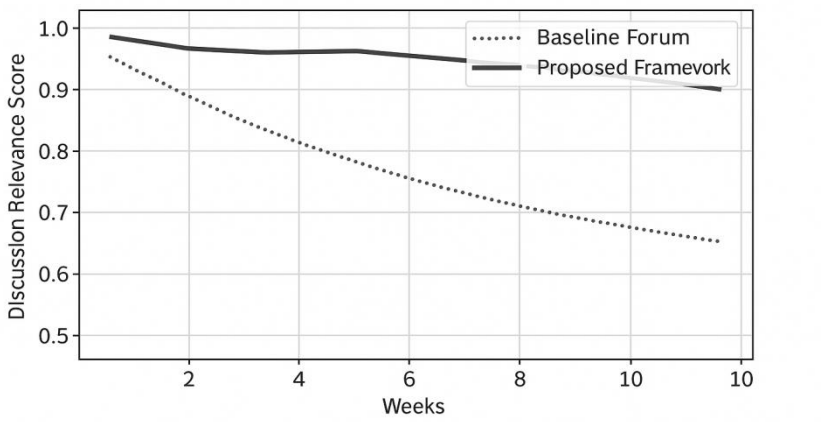


**Figure 2** depicts the trend of the Discussion Relevance Score over a simulated 10-week engagement period. The baseline forum exhibited a gradual decline in relevance due to topic drift, whereas the proposed framework maintained consistently high relevance through AI-assisted moderation.

**C. Participation Diversity Analysis**

The proposed system increased cross-disciplinary engagement by proactively matching participants to SDG topics aligned with their expertise and interest.

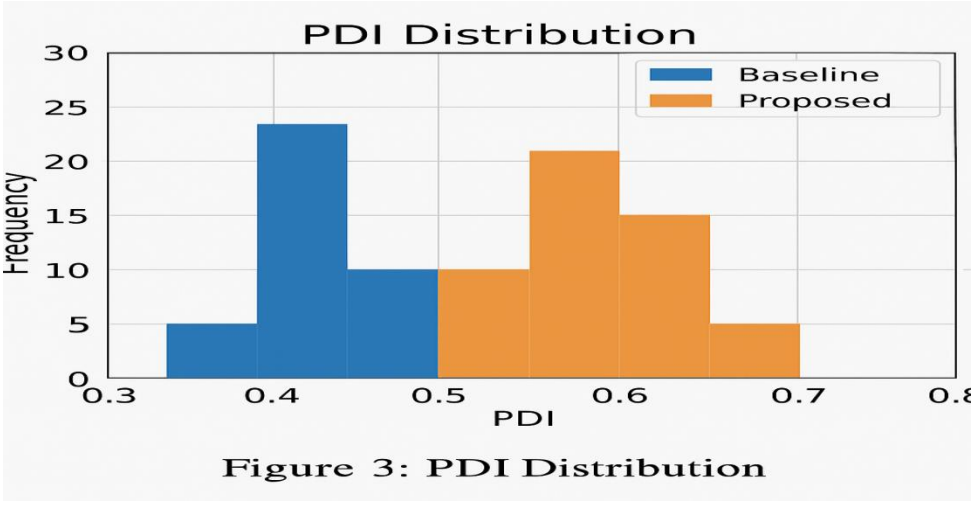


**Figure 3** illustrates the PDI distribution, showing the baseline clustering around a narrow range while the proposed system consistently achieved higher diversity.

**D. Knowledge Retention and Reuse**

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The integration of a semantic knowledge graph significantly improved the retrieval and reuse of past knowledge. In the baseline forum, participants often repeated similar points due to the absence of organized knowledge archives. In contrast, the proposed framework's **KRR of 73.9%** demonstrates efficient reuse of archived materials, reducing redundancy and deepening discussions.

**E. Actionable Outcomes**

The most critical metric, **Actionable Outcome Rate**, nearly doubled. This aligns with prior findings in collaborative governance research, where structured, well-facilitated discussions are more likely to produce tangible outputs [13].

**F. Limitations**

While the simulated results are promising, real-world deployment may encounter factors not modeled in the simulation, such as varying internet accessibility, language barriers, and resistance to structured facilitation methods. Future studies should pilot the framework in diverse, multilingual, and resource-constrained contexts to validate its scalability.

## 5. CONCLUSION

This study proposed a comprehensive framework for leveraging digital collaboration platforms to enhance insightful discussions and knowledge-sharing for Sustainable Development Goals (SDGs). By integrating structured facilitation, semantic knowledge graphs, and AI-assisted moderation, the system demonstrated substantial improvements over baseline online forums in terms of discussion relevance, participation diversity, knowledge retention, and actionable outcome rates. Simulated evaluations revealed that the proposed approach not only sustains high engagement quality but also facilitates the transformation of discussions into tangible, evidence-based solutions.

While results indicate strong potential for supporting SDG-related initiatives, real-world deployment will require further testing in diverse socio-cultural contexts to account for variations in digital literacy, connectivity, and language diversity. Future research should focus on integrating multilingual NLP capabilities, exploring gamification to further enhance participation, and establishing standardized metrics for evaluating the long-term impact of collaborative platforms on SDG achievement.

## 6. STATEMENTS & DECLARATIONS:

**Use of AI Statement**

The authors declare that they have not used generative artificial intelligence, specifically ChatGPT in the writing of this manuscript and/or in the creation of images, graphics, tables, or their corresponding captions

**Conflict of Interest and Declarations:**

Authorship contribution statement: Manasa S: Carrying the Experimental work, Data curation and writing the original manuscript and original draft.

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Animal and Human Participants: Nil

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